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BOOK REVIEWS.

HERMANN VON HELMHOLTZ'S UNTERSUCHUNGEN ÜBER DIE GRUNDLAGEN DER MATHEMATIK UND MECHANIK. By *Dr. Leo Koenigsberger*, Professor of Mathematics in Heidelberg. Leipsic: B. G. Teubner. 1896. Pages, 58. Price M. 2.40.

The present pamphlet, which is the elaboration of an address delivered last year on the occasion of a memorial celebration in honor of Karl Friedrich, the rehabilitator of the University of Heidelberg, gives a rapid but lucid presentation of the scientific achievements of Helmholtz in everything relating to mathematics and mechanics. One gets from it a renewed and deepened sense of the tremendous comprehensiveness of Helmholtz's scientific activity, which in this respect has scarcely been rivalled by any inquirer of ancient or modern times, with the single exception, perhaps, of Aristotle. Many have exhibited greater acumen and genius in one or a few departments, but none have left the impress of originality and profundity on so many. Galileo, Huygens, Thomas Young, Faraday, J. R. Mayer, Lagrange, Gauss, possibly surpassed him in scope and significance of individual achievements, in classical elegance of presentation, or in philosophical grasp, but they have not rivalled his wonderful versatility which alternately resumed and elaborated nearly every province of positive, physical research. There have been some who have denied him genius of the purest and most unqualified type, but none can gainsay his having reached the pinnacle of consummate virtuosity. His name has drawn to itself and absorbed a preponderating share of the scientific achievements of the closing half of the nineteenth century, and like all overtowering personalities his fame will no doubt be handed down to posterity associated with performances in which others have taken no less distinguished and perhaps even more prominent a part. With few exceptions he is unconsciously accredited in all academical circles not only with the independent enunciation of the principle of the conservation of energy, that crowning generalisation of the science of our century, but even with its sole enunciation, and in the popular world the tendency is absolutely dominant, to accord to him the sole merit of its discovery. Impartial judges assert that Mayer, even barring the questions of independence and priority, which certainly belong to the Heilbronn physician, was, date for date, far ahead of Helmholtz in the philosophical appreciation of the principle. Certainly there can be no doubt of Mayer's merits and share in the original discovery. Yet Helmholtz's, not Mayer's, name will go down in popular imagination and history exclusively associated with the greatest scientific triumph of our age. Thirty years ago and more, his claims on the same head were, in an able article in the *English Cyclopedia*, entirely subordinated to those of Grove, who delivered his lecture on the "Correlation of Physical Forces" as early as 1842. Now, in the accounts of the discovery of the law, there is scarcely a mention of Grove—such is the increasing inertia of a scientific reputation. And as he overshadowed in this province Mayer, Joule, Carnot, and others, so, too, in his famous researches regarding the foundations of mathematics, in his great systematic investigations of physiological optics and acoustics, he naturally and by sheer force of his scientific ascendancy obscured or ingurgitated a goodly portion of the work of other equally meritorious inquirers.

But this is not strange. The same natural result has occurred in the case of all great historical and scientific personalities, and even of places, though in a less degree now-a-days than in the old mythical periods. It is an imperative social law. Legend and history attribute to Charlamagne all that was good and great in his time: Venice, Rome, and Troy[1] are the inheritors of all the glories and of the history of their namesakes; and so in a successively diminishing degree Pythagoras, Aristotle, Newton, Leibnitz, and Alexander von Humboldt have stood as the epitomes and incarnations of their scientific time, country, and domain. Gigantic maelstroms, they have sucked into their maws the philosophical and scientific driftwood of nearly the whole contemporary world!

One of the most embittered opponents of Helmholtz's title to genius and fame is Dr. E. Dühring, a highly independent, powerful, and versatile thinker, who many years ago conducted a battle royal with the authorities and faculty of the University of Berlin on the occasion of his being refused a chair of philosophy in that institution. In this encounter Helmholtz drew upon himself Dühring's undying wrath. Speaking of the confusion which exists in the popular mind regarding the intrinsic worth of the great scientists and thinkers of the world who by the vulgar are universally rated much lower than the fashionable authorities of the day, Dühring once cited as an instance a passage in Schlosser's *Universal History* where the well-known historian in a grandiloquent dash of rhetoric speaks of "the history of mathematics from Archimedes to Kästner!" Kästner, a professorlet in the last century at the University of Göttingen, whose main achievement was a tolerable history of mathematics, and Archimedes, the incarnation of the mathematical genius of antiquity! "Really," interpolates Dühring with fine derision, "One might as well speak of the history of physics from Galileo to *Helmholtz*!"

Contrasted with this exaggerated scorn we may place the present estimate of Dr. Koenigsberger, Professor of Mathematics in Heidelberg, which exhibits the glorious plenitude of Helmholtz's work in but a single department. We read here of his philosophical discussions relative to the foundations of mathematics, which opposed the modern empirical view to the transcendentalism of Kant; of his physiological and psychological researches which furnished the foundations of his subsequent empirical theory of the origin of space and time; of his researches in the non-Euclidean geometry proper; of his application of the latter to colors; of his enunciation of the principle of the conservation of work; of his hydrodynamical and aerodynamical investigations; of his theory of vortices; of his researches in electricity; of his consequent examination of the fundamental principles of mechanics and the theorems resulting therefrom; and finally of his theories regarding the dynamic constitution of matter, the ether, etc. This last was the final work of his life, and we learn that the intended subject of his address at the meeting of the German physicians and inquirers in Vienna was actually "Permanent Forms of Motion and Apparent Substances." What the character of this address would have been is unknown, as only a few notes regarding it were found among Helmholtz's literary remains, but it is supposed that it would have elaborated the philosophical foundation of the extensive researches which he had been conducting in his last years regarding the basic principles of mechanics and physics and at which he had hinted in his Introduction to the *Mechanics* of Hertz. Of his achievements in this department, let us finally add, the reader will find in this pamphlet of Dr. Koenigsberger a concise and worthy account. A fine portrait of Helmholtz taken from the oil painting in the possession of Frau Ellen von Siemens, forms the frontispiece of the brochure.

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[1] See Carus Sterne's *Trojaburgen*. Glogau. 1893.

THOMAS J. MCCORMACK.

DIE UEBERWINDUNG DES WISSENSCHAFTLICHEN MATERIALISMUS. By *Wilhelm Ostwald*, Professor der Chemie an der Universität Leipzig. Leipsic: Veit & Comp. 1895. Pages, 36.

This pamphlet of thirty-six pages is a lecture which Prof. Wilhelm Ostwald, one of the most prominent chemists of Germany, and Professor at the University of Leipsic, delivered on September 20, 1895, before the Association of German Naturalists and Physicians at Lübeck. It is a protest against the materialism of science, and the author is fully aware that he has taken a position at variance with the opinions of many great scientists. He has the consciousness of a lookout whose duty it is to call "breakers ahead!"

The famous *Ignorabimus* of Du Bois-Reymond is in Professor Ostwald's opinion nothing but a protest against the mechanistic world-conception which is at present dominant in scientific circles. Ostwald does not seriously believe in the *Ignorabimus*, but claims that we have not as yet fully understood the salient point of the problem, for there are processes which are not representable by mechanistic equations, and this much is certain that we must give up the hope of interpreting the world as a mere play of atoms. Professor Ostwald proposes to replace mechanism by the energetic world-conception. The result of his investigation remains